

Examining the Relationship Between Hospital-Community Partnerships and COVID-19 Case-Fatality Rates

Sinyoung Park, PhD,ⁱ Hanadi Y. Hamadi, PhD,ⁱⁱ Anh Tran Nguyen, MHA, BS, Veronica Tran, BS, Donald Rob Haley, PhD, MBA, MHS, and Mei Zhao, PhD

Abstract

During the COVID-19 pandemic, hospitals across the United States were tasked to develop partnerships with other hospitals and community organizations to overcome the unexpected challenges. The aim of this study is to examine COVID-19 case-fatality rates and explore their relationship with hospital-community partnerships. This study employed a cross-sectional design using a multilevel generalized linear model with a Poisson regression distribution and publicly available COVID-19 mortality data from February to October 2020 across 2526 hospital service areas (HSAs). HSAs with a greater number of partnerships were found to have a reduced risk of higher case-fatality rates than those with fewer health system partnerships. The findings indicated the need for greater cooperation between individual health care systems, state and local governments, and community programs for better outcomes in the ongoing and evolving COVID-19 pandemic, and to be better prepared for future pandemics or large-scale public health crises. This study provides the necessary insights for policy makers, hospital administrators, and public health leaders to understand the critical importance of community partnerships and their influence on reducing the COVID-19 case-fatality rate, as well as their potential effects on improving the health of vulnerable populations as a means to achieve the Centers for Disease Control and Prevention's goal of achieving health equity. This research illustrates the need for further inquiries into the importance of these health care partnerships for positive health care outcomes.

Keywords: COVID-19, hospital, partnership, case-fatality rates

Introduction

THE CORONAVIRUS DISEASE 2019 (COVID-19), a severe acute respiratory syndrome coronavirus 2 infection, is a global health crisis that presents critical challenges to the public health, research, and medical communities.¹ Transmission of the disease from person-to-person caused local and federal authorities to take extensive measures to contain the outbreak. To date (April 21, 2021), the virus has infected 143,117,764 people and has been detected in almost every country.² To reduce the extent of the spread, many communities have implemented nonpharmaceutical interventions such as social distancing, limiting capacities in closed areas, and isolating those who have been infected or exposed.

In the United States, the spread of COVID-19 validates that not all Americans are equally susceptible to the effects of the pandemic. One of the most significant public health barriers that contributes to this dynamic is social determinants

of health. Social determinants such as living conditions, access to proper education, and exposure to violence negatively affect the health and well-being of people.³ In many cases, social determinants also contribute to the prevalence of chronic conditions (eg, asthma, hypertension, chronic kidney disease) and other afflictions that render individuals more susceptible to complications of COVID-19.⁴ One of the tools that public health professionals and government authorities could employ to address the aforementioned shortcomings during the battle against COVID-19 is strategic partnerships between hospitals and community resources.⁵

Social determinants of COVID-19

Social vulnerability is driven by socioeconomic status, household composition and disability, minority status and language knowledge, and housing type and transportation.⁶ Greater vulnerability in these domains is linked with the consequence of

Department of Health Administration, Brooks College of Health, University of North Florida, Jacksonville, Florida, USA.

ⁱORCID ID (<https://orcid.org/0000-0001-5780-9386>).

ⁱⁱORCID ID (<https://orcid.org/0000-0001-9050-7267>).

being at a much higher risk of suffering COVID-19 infection or death. In the minority status and language domains, people in the most vulnerable counties had a 4.74- to 4.94-fold greater risk of dying or suffering from COVID-19.⁷

John McLaren of the National Bureau of Economic Research stated in his research that the COVID-19 mortality rates of minority groups such as Hispanics/Latinos and African Americans are approximately double and triple that of their Caucasian American counterparts.⁸ The disproportion is evident at both national and state levels—African Americans represent 13.4% of the population, but constituted 40% of COVID-19-related hospitalizations.⁹

Need for community partnerships

The sudden and rampant onset of COVID-19 has exposed the existing barriers of access to care in the United States, particularly in the ability to respond to the outbreak quickly and fairly between different demographics and socioeconomic counterparts. In addition, it further highlights a need for partnerships between providers and communities, as addressing the existing health disparities would vastly reduce the impact of the virus.¹⁰ Supporting evidence that bolsters this relationship is the official COVID-19 partnership guideline from the American Hospital Association, which specifically instructs hospitals and health systems to use the readily available resources of local and community organizations to combat the outbreak.¹¹ The community resources mentioned could provide benefits of more rapid personal protective equipment (PPE) production, spreading awareness of risk factors and social distancing, and efficient testing distribution.¹¹ A demonstration of where community resources and partnerships helped to address the outbreak is a case study from Massachusetts, where the state's health department was able to use community health resources to protect its population with mental illness.¹² The state was able to assist providers with delivering more robust care through telehealth and the supply chain of medications.

Influence of hospital partnerships

The Robert Wood Johnson Foundation Commission to Build a Healthier America recommended that communities must implement and foster health-promoting behaviors.¹³ Such efforts would require participation and commitment from multiple stakeholders – public health, housing, education, nutrition, transportation, and others – to collaborate and work toward a common goal. An expanded multisector network with the focus of enabling population health services is significantly better at reducing mortality rates regarding preventable diseases.¹⁴ Furthermore, another study also bolsters the notion that the benefits garnered from these partnerships are exponential and exceed the sum of their parts.¹⁵ Aside from the improvement of health status, partnerships also significantly reduce the cost of care within the community.¹⁵

In order to combat the aforementioned disparities and their detrimental impact during pandemics of a global scale such as COVID-19, strategic partnerships between hospitals and community resources should be considered a continually developed tool. One of the advantages of using these resources is that they could be deployed in a short amount of time, which is an appropriate factor in responding to a public health crisis. However, to fully realize the effec-

tiveness of these resources, hospitals need to have built and established meaningful relationships with the community beforehand. Bearing this sentiment in mind, the authors of this study aim to highlight the impact of COVID-19 and how hospital-community partnerships come into play with case-fatality rates. Even though there are ample studies on the effect of hospital and community partnerships, there is little evidence on how influential they could be during the COVID-19 pandemic at the hospital service level.

Methods

A secondary cross-sectional design was used to analyze census data of hospital service areas (HSA) in the United States.

Data sources

Publicly available county and state-specific data were used from the Area Health Resources File, Centers for Disease Control and Prevention Atlas File, American Hospital Association Annual Survey, Current Population Survey, COVID-19 US States Policy Database,¹⁶ and John Hopkins COVID-19 Data.¹⁷ Key demographic, socioeconomic, and health delivery characteristics were identified that have been shown to influence the risk of exposure to COVID-19 based on recently published studies.^{18–20}

Variables

The outcome variable was the case-fatality ratio of COVID-19. The ratio is calculated by dividing the number of total deaths since February 29, 2020 (first confirmed death in the United States) by the total number of confirmed cases as of October 2, 2020.²¹

There were 5 key independent variables in this study that measured type of hospital partnership (collaborative or formal alliance). The American Hospital Association Annual Survey asked hospitals to describe their current working relationship (not involved, collaborative, or formal alliance) with 9 types of organizations: (1) health care providers outside their system, (2) local or state public health organizations, (3) local or state human/social service organizations, (4) other local or state governments, (5) nonprofit organizations, (6) faith-based organizations, (7) health insurance companies, (8) schools, and (9) local businesses or chambers of commerce. These 9 types of organization partnerships were first operationalized into 4 categories: Health Care System Partnership, Community-Based Partnership, Local Agency Partnership, and Schools (Table 1). They were operationalized by first aggregating the total number of partnerships within a county across all its hospitals, and then aggregating again to the HSA level.

State-level covariates. A COVID-19 mitigation score was created at the state level. This is a composite measure of states' social distancing policy efforts to mitigate the spread of COVID-19. The score has 5 equally weighted policies: stay-at-home order, mandatory quarantine for travelers, nonessential business closures, large gatherings banned, and restaurant limits. Each policy effort was purposefully weighted equally because there is no strong evidence to rigorously assign importance across each of the 5 policy

TABLE 1. CATEGORIES OF COLLABORATIVE AND FORMAL ALLIANCE PARTNERSHIP HOSPITALS FORM

Health Care System Partnership	• Health care providers outside your system • Health insurance companies
Community-based Partnership	• Faith-based organizations • Nonprofit organizations
Local Agency Partnership	• Local or state public health organizations • Local or state human/social service organizations • Other local or state government
Schools	• Schools
Overall Partnership	• Health Care System Partnership • Community-based Partnership • Local Agency Partnership • Schools

categories. Each state's effort was measured as the total number of days between the effective date of the policy and the roll-back date of the policy or still effective as of October 2, 2020 (study selected cutoff date). The higher the COVID-19 mitigation score, the longer the social distance policies have been in place.

HSA-level covariates. The HSA level factors were all average scores between 2013 and 2018, which included hospital system characteristics such as total number of intensive care unit (ICU) beds, total number of hospitals that are part of a system, total number of teaching hospitals, total number of not-for-profit hospitals, average Herfindahl-Hirschman Index (HHI), total average of hospitals' Medicare percentage, and total number of hospitals. Also included were community health characteristics such as total number of health professional shortage counties, average percent uninsured, and average percent of age-adjusted diabetes prevalence. Community population characteristics such

as average percent of the population aged ≥ 65 years, average percent of the population who are African American, and average population density also were included.

Statistical methods

The findings are summarized using descriptive statistics of HSAs using means and standard deviations. To examine the association between hospital partnership and COVID-19 case-fatality ratio a multilevel model was fitted because of the hierarchical structure of the data; this was done to account for clustering at both the state and HSA levels. Because the outcome variable is a ratio of COVID-19 deaths, a multilevel generalized linear model with a Poisson regression distribution and robust error variance was used. To assess the clustering effect and multicollinearity, the intraclass correlation coefficient and variance inflation factor were examined. Furthermore, Akaike's and Schwarz's Bayesian information criteria were used to determine model fit. To account for COVID-19 exposure, population density was included as an exposure term in the model. Variables with a P value < 0.05 were considered to be significant in the fitted model. All analytical analyses were carried out using Stata Statistical Software: Release 16SE (StataCorp LLC, College Station, TX).

Results

The sample consisted of 2526 HSAs. The mean COVID-19 case-fatality rate was 2.37 with a 2.18 standard deviation. The highest average COVID-19 case-fatality rate was 29.41. Additional HSA characteristics are displayed in Table 2.

Table 3 reports the results of the model that examined the different types of hospital partnerships and case-fatality rate. HSAs with a greater number of health system partnerships were found to have a 9% reduced risk of higher case-fatality rates than those with fewer health system partnerships. Those HSAs with a greater number of community

TABLE 2. DESCRIPTION OF HOSPITAL SERVICE AREA CHARACTERISTICS, N = 2526

	Mean	Standard deviation	Minimum	Maximum
Case-fatality rate	2.37	2.18	0.00	29.41
Overall partnership	0.47	0.90	0.00	11.00
Health system partnership	0.64	1.06	0.00	13.00
Community partnership	0.67	1.08	0.00	13.00
Local agency partnership	0.77	1.08	0.00	12.00
School partnership	0.91	1.12	0.00	13.00
Mitigation score	56.15	26.20	7.20	129.40
Number of ICU beds	11.63	15.25	0.00	142.17
Number of hospitals part of a system	1.03	1.35	0.00	15.00
Number of teaching hospitals	0.66	1.27	0.00	17.00
Number of not-for-profit hospitals	0.98	1.19	0.00	17.00
Average Herfindahl-Hirschman Index	0.69	0.34	0.00	1.00
Average hospital Medicare percentage	53.14	16.16	1.97	100.00
Average number of counties in an HSA that are health provider shortage areas	1.41	1.51	0.00	20.00
Average percent of uninsured population	12.42	4.73	2.44	32.94
Diabetes mellitus prevalence, age adjusted	10.01	3.25	1.50	24.30
Average percent of adults aged ≥ 65	17.77	4.27	6.40	55.60
Average percent of African Americans	8.38	12.65	0.00	85.80
Total number of hospitals	1.54	1.48	1.00	20.00
Average population density	476.69	2051.42	0.10	69468.40

HSA, hospital service area; ICU, intensive care unit.

TABLE 3. MULTILEVEL GENERALIZED LINER REGRESSION OF COVID-19 CASE-FATALITY RATES AND HOSPITAL PARTNERSHIPS WITHIN A HOSPITAL SERVICE AREA

	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Health system partnership	0.91***	[0.87,0.94]						
Community partnership			0.90***	[0.86,0.94]				
Local agency partnership					0.90***	[0.86,0.93]		
School partnership							0.91***	[0.88,0.95]
Mitigation score	0.99	[0.98,1.00]	0.99	[0.98,1.00]	0.99	[0.98,1.00]	0.99	[0.98,1.00]
Number of ICU beds	0.98***	[0.98,0.98]	0.98***	[0.98,0.98]	0.98***	[0.98,0.98]	0.98***	[0.98,0.98]
Number of hospitals part of a system	0.85***	[0.81,0.88]	0.85***	[0.81,0.88]	0.84***	[0.81,0.88]	0.84***	[0.81,0.88]
Number of teaching hospitals	0.85***	[0.81,0.89]	0.85***	[0.81,0.88]	0.85***	[0.81,0.89]	0.84***	[0.81,0.88]
Number of not-for-profit hospitals	1.01	[0.96,1.05]	1.01	[0.96,1.06]	1	[0.96,1.05]	1	[0.96,1.05]
Average Herfindahl-Hirschman Index	4.40***	[3.94,4.92]	4.37***	[3.91,4.88]	4.37***	[3.91,4.88]	4.37***	[3.91,4.88]
Average hospital Medicare percentage	1	[1.00,1.00]	1	[1.00,1.00]	1	[1.00,1.00]	1	[1.00,1.00]
Average number of counties in an HSA that are health provider shortage areas	0.99	[0.92,1.06]	0.98	[0.91,1.05]	0.98	[0.91,1.05]	0.98	[0.91,1.05]
Average percent of uninsured population	1.02***	[1.01,1.03]	1.02***	[1.01,1.03]	1.02***	[1.01,1.03]	1.02***	[1.01,1.03]
Diabetes mellitus prevalence, age adjusted	1.07***	[1.06,1.08]	1.07***	[1.06,1.08]	1.07***	[1.06,1.08]	1.07***	[1.06,1.08]
Average percent of adults aged ≥65	1.12***	[1.11,1.12]	1.12***	[1.11,1.12]	1.12***	[1.11,1.12]	1.12***	[1.11,1.12]
Average percent of African Americans	1.00*	[0.99,1.00]	1.00*	[0.99,1.00]	1.00*	[0.99,1.00]	1.00*	[0.99,1.00]
Total number of hospitals	1.20***	[1.11,1.30]	1.22***	[1.12,1.32]	1.23***	[1.13,1.33]	1.23***	[1.13,1.34]
AIC	12419.9794		12417.0169		12415.2649		12425.7226	
BIC	12513.3297		12510.3672		12508.6151		12519.0729	

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$.

AIC, Akaike information criterion; BIC, Bayesian information criterion; CI confidence interval; HSA, hospital service area; ICU, intensive care unit; OR, odds ratio.

partnerships had a 10% reduced risk of higher case-fatality rates than those with fewer community partnerships. Those HSAs with a greater number of local agency partnerships had a 10% reduced risk of higher case-fatality rates than those with fewer local agency partnerships. Lastly, those HSAs with a greater number of school partnerships had a 9% reduced risk of higher case-fatality rates than those with fewer school partnerships (Table 3).

Table 4 reports the results of the model that examined the overall total number of hospital partnerships and case-fatality rate. HSAs with a greater number of overall partnerships were found to have a 12% reduced risk of higher case-fatality rates than those with fewer health system partnerships.

Community factors that consistently decrease the likelihood of a greater case-fatality rate in the models (Table 3 and 4) were number of ICU beds, number of hospitals that are part of a system, and number of teaching hospitals. However, an increase in HHI, which indicates lower market share competition, percent of uninsured, prevalence of diabetes mellitus, population aged ≥65 years, percent African American, and the total number of hospitals have all shown to increase the odds of greater COVID-19 case-fatality rates.

Discussion

This study investigated the association between hospital partnership and COVID-19 case-fatality rate at the HSA

level. The findings showed a relationship with HSAs with more partnerships of any sort (health care systems, community-based organizations, local agencies, and schools) with lower case-fatality rates than their counterpart organizations with no such partnerships. This suggests that having any type of partnership is associated with positive outcomes, as all partnership types had a similar effect on the COVID-19 case-fatality rate. This result supports the previous literature that emphasizes the importance of surge capacity for the effective use of the resources available. Appropriate partnerships would ensure the best possible care through shared resources, incident management, and a triaged response framework in case of unexpected strain on health care capacity caused by events such as the COVID-19 pandemic.²² Hospital systems that have a greater number of partnerships also could indicate that the organization is more forward-thinking and structured in such a way that it is built on principles that allow it to change based on the crises it is facing, in comparison to a hospital that refuses to do so. This finding confirmed the importance of hospital partnerships and how they are associated with better community and population outcomes during a pandemic-level event and can be beneficial for the reduction of other contagious and infectious diseases.

This finding also adds to the body of literature that emphasized the potential outsized effects of partnerships on population-level outcomes. Previous literature conducted

TABLE 4. MULTILEVEL GENERALIZED LINER REGRESSION OF COVID-19 CASE-FATALITY RATES AND HOSPITAL OVERALL PARTNERSHIP WITHIN A HOSPITAL SERVICE AREA

	OR	95% CI
Overall partnership	0.88***	[0.84,0.91]
Mitigation score	0.99	[0.98,1.00]
Number of ICU beds	0.98***	[0.98,0.98]
Number of hospitals part of a system	0.85***	[0.82,0.89]
Number of teaching hospitals	0.86***	[0.82,0.89]
Number of not-for-profit hospitals	1.01	[0.96,1.05]
Average Herfindahl-Hirschman Index	4.38***	[3.92,4.90]
Average hospital	1	[1.00,1.00]
Medicare percentage		
Average number of counties in an HSA that are health provider shortage areas	0.98	[0.92,1.05]
Average percent of uninsured population	1.02***	[1.01,1.03]
Diabetes mellitus prevalence, age adjusted	1.07***	[1.06,1.08]
Average percent of adults aged ≥65	1.11***	[1.11,1.12]
Average percent of African Americans	1.00*	[0.99,1.00]
Total number of hospitals	1.19***	[1.10,1.29]
AIC	12403.1612	
BIC	12496.5114	

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$.

AIC, Akaike information criterion; BIC, Bayesian information criterion; CI confidence interval; HSA, hospital service area; ICU, intensive care unit; OR, odds ratio.

based on case studies found that hospital-community partnerships resulted in positive population-level outcomes, mainly focusing on chronic disease prevention, influenza, and public health concerns such as a reduction in lead poisoning among children in New York City, a reduction in infant mortality rate among African Americans in Boston, and a reduction in adolescent pregnancy in South Carolina.^{14,23}

In addition, HSAs with more ICU beds, hospitals with system membership, and teaching hospitals were associated with lower COVID-19 case-fatality rates, while less competitive HSAs tended to have higher COVID-19 case-fatality rates. Some part of this could be attributed to the possibility that, in comparison to their counterpart institutions, teaching hospitals and hospitals with greater resources related to system membership, by their nature and their potential association with research, would tend to be more on the cutting edge regarding the emergent data on how to treat severe cases of COVID-19. This finding mirrors previous research that identified that local hospital bed and ICU bed capacity are related to the community's ability to respond to increased strain on the health care system caused by COVID-19.²⁴ Teaching hospitals have a greater capacity to assimilate, test, and use the most up-to-date evidence-based practice guidelines, return to work policies, PPE guidance, and testing algorithms²⁵; therefore, they can treat their patient population more effectively in comparison to nonteaching hospitals of comparable size.

HSAs with a larger uninsured population, higher diabetes prevalence rate, and older populations were more likely to have higher COVID-19 fatality rates. These findings support

the literature on the need and significance of social determinants of health, pushed to criticality by the COVID-19 pandemic.²⁶ Not only is there a greater need to address these conditions, but the COVID-19 pandemic made these issues worse, with even greater separation of vulnerable patient populations from their much-needed health care.

Limitations

This study has several limitations that should be addressed in future studies. First, there is a lack of information on causality between partnership and case-fatality rates because of the cross-sectional study design, so further investigation with longitudinal data is needed. Second, there could be unmeasured community characteristics that affect case fatality, such as community social and economic factors, including percent of households below the poverty line, income inequality, unemployment rates, community safety, diversity, or social capital.²³ Also, hospital and environmental characteristics could potentially play into the severity of disease, which could affect case fatality. For instance, hospital geographic location and how that relates to potential vitamin D deficiencies, a determinant for severity of disease, could be added for future study to measure more accurate effects of partnerships on population health outcomes. Although the present study included a mitigation score that measured social distancing policies enacted by counties, this score did not take into consideration public willingness to abide by these policies or county administrations' willingness to enforce such policies. In addition, this study did not take into account if the partnership at the hospital level was with 1 hospital or multiple hospitals, which means the data did not indicate the strength or length of partnerships the hospitals created and only indicated the absence or presence of a partnership. Despite this, it would be reasonable to assert that hospitals that cultivated these valuable external relationships could draw on them during times of crises to assist with events that could affect population health.

Policy and practice implications

This study provides insight for policy makers, hospital administrators, and public health leaders to understand the critical importance of community-hospital partnerships and their influence on reducing the case-fatality rate from COVID-19. Policy makers need to better understand this association and its potential effect on improving the health of various populations as a means to achieve the Centers for Disease Control and Prevention (CDC) National Center for Chronic Disease Prevention and Health Promotion goal of achieving health equity.²⁷ Health equity, or health justice, is often defined as every person having the opportunity to attain their full health potential regardless of race, ethnicity, or socioeconomic class.²⁸ For example, present study results indicate that health equity was better achieved when hospitals developed partnerships with other health care systems, community-based organizations, local agencies, and schools. These partnerships were found to be especially important in decreasing the COVID-19 case-fatality rate during the height of the pandemic crisis, regardless of the socioeconomic and racial diversity status of HSAs.

Study findings are particularly important to hospital and health system administrators because as the industry

continues to transition to hospital value-based purchasing (HVBP), hospitals must identify innovative opportunities to improve the health of their community. HVBP is a payment reform methodology that integrates financial incentives and disincentives for health care providers to improve the quality and delivery of health care, which has been in effect since 2013 as a part of the Patient Protection and Affordable Care Act of 2010.²⁹ It is a payment methodology that links hospital Medicare payments to improving the quality of health for certain hospital-acquired conditions, harms, and unexpected readmissions.³⁰ Present study findings suggest that hospitals and health systems should be encouraged to actively and intentionally create multisector community partnerships to facilitate a more cohesive and higher quality of care, leading to a healthier population and achieving the CDC's goal of health equity. This can result in increased hospital reimbursements for hospitals and health systems under Medicare's HVBP.

As a result, health care providers have been developing Accountable Care Organizations (ACOs) that accept responsibility for the quality and cost of care for their patients.³¹ Therefore, ACOs have been actively creating and developing community relationships to improve the health of their communities, and thus, improving the health of their members. For example, HealthPartners is a large Minneapolis–St. Paul-based ACO that is composed of an integrated health delivery system with thousands of physicians, 5 hospitals, and a large health insurance plan. HealthPartners began financially investing in developing linkages with community organizations and also providing leadership support and development to these organizations, resulting in the creation and support of public health services for children and families.³²

In addition to ACOs, individual hospitals are facilitating the development of community partnerships that improve the health of their HSA. For example, St. Catherine Hospital in Garden City, Kansas developed unique and sustainable community partnerships by leading a coalition of more than 50 community health partners to focus on reducing risky behaviors among teenagers, improving transportation, providing support for families through literacy training, and preventing domestic violence. This coalition was effective in decreasing the incidence of smoking by supporting and promoting no-smoking legislation, creating a fixed bus route, and establishing family literacy programs.³³ Similarly, St. Joseph Hospital in Sonoma, California supports programs that train community activists to influence policy that improves the health of their community. For example, this program organized community gardens, created a farm cooperative, and lobbied for healthier food within the public school system.³⁴

Finally, this research found that HSAs with hospitals and health systems that partner with local agencies and schools were associated with lower COVID-19 case-fatality rates. Because of the nature of the design of the study, one cannot make a causal assumption about these partnerships and positive health outcomes. It would be important to understand the underlying interactions of these partnerships with other factors that play into COVID-19 case mortality in a prospective manner. Fortunately, it seems to be past the point where such a study could reliably be conducted with COVID-19. However, looking prospectively at how HSAs and partnerships with outside agencies affect population

health in relation to other large-scale health-related issues, such as the opioid epidemic, could be a potential avenue for study.

Conclusion

This study makes a significant contribution to the literature by underscoring the need for greater vertical and horizontal cooperation between the different players within the public health scope. Partnerships between groups can assist in many ways when the public health system is taxed in unprecedented ways, such as sharing material and human resources, as well as greater coordination of care, from triage, to contact tracing, to treatment, and follow-up care. This study indicated the need for greater sustainable cooperation between individual health care systems, state and local government, and community programs for better outcomes in not only the ongoing and evolving COVID-19 pandemic, but future pandemics and large-scale public health crises.

Authors' Contributions

Dr. Park: Conception or design of the work, drafting the article, critical review and revision of the article, final approval of the version to be published. Dr. Hamadi: Conception or design of the work, data collection, data analysis and interpretation, drafting the article. Mr. Nguyen: Drafting the article. Ms. Tran: Drafting the article. Dr. Haley: Drafting the article, critical review and revision of the article. Dr. Zhao: Drafting the article, critical review and revision of the article.

Author Disclosure Statement

The authors declare that there are no conflicts of interest.

Funding Information

No funding was received for this article.

References

1. Fauci AS, Lane HC, Redfield RR. Covid-19—navigating the uncharted. *N Engl J Med* 2020;382:1268–1269.
2. JHU. Coronavirus Resource Center. 2020. <https://coronavirus.jhu.edu/> Accessed April 22, 2021.
3. Thornton RL, Glover CM, Cene CW, Glik DC, Henderson JA, Williams DR. Evaluating strategies for reducing health disparities by addressing the social determinants of health. *Health Aff (Millwood)* 2016;35:1416–1423.
4. Singu S, Acharya A, Challagundla K, Byreddy SN. Impact of social determinants of health on the emerging COVID-19 pandemic in the United States. *Front Public Health* 2020;8:406.
5. WHO. Risk communication and community engagement readiness and response to coronavirus disease (COVID-19). 2020. <https://apps.who.int/iris/bitstream/handle/10665/331513/WHO-2019-nCoV-RCCE-2020.2-eng.pdf> Accessed November 17, 2020.
6. Berger ZD, Evans NG, Phelan AL, Silverman RD. Covid-19: control measures must be equitable and inclusive. *BMJ* 2020;368:m1141.
7. Khazanchi R, Beiter ER, Gondi S, Beckman AL, Bilinski A, Ganguli I. County-level association of social vulnerability with COVID-19 cases and deaths in the USA. *J Gen Intern Med* 2020;35:2784–2787.

8. Gross CP, Essien UR, Pasha S, Gross JR, Wang SY, Nunez-Smith M. Racial and ethnic disparities in population-level Covid-19 mortality. *J Gen Intern Med* 2020;35:3097–3099.
9. Gaynor TS, Wilson ME. Social vulnerability and equity: the disproportionate impact of COVID-19. *Public Adm Rev* 2020;80:832–838.
10. Michener L, Aguilar-Gaxiola S, Alberti PM, et al. Engaging with communities—lessons (re)learned from COVID-19. *Prev Chronic Dis* 2020;17:E65.
11. AHA. COVID-19: Partnering to address COVID-19 in under an hour. 2020. <https://www.aha.org/system/files/media/file/2020/04/Partnering-to-address-COVID-19.pdf> Accessed November 17, 2020.
12. Bartels SJ, Baggett TP, Freudenreich O, Bird BL. COVID-19 emergency reforms in Massachusetts to support behavioral health care and reduce mortality of people with serious mental illness. *Psychiatr Serv* 2020;71:1078–1081.
13. Mattessich PW, Rausch EJ. Cross-sector collaboration to improve community health: a view of the current landscape. *Health Aff (Millwood)* 2014;33:1968–1974.
14. Mays GP, Mamaril CB, Timsina LR. Preventable death rates fell where communities expanded population health activities through multisector networks. *Health Aff (Millwood)* 2016;35:2005–2013.
15. Brewster AL, Brault MA, Tan AX, Curry LA, Bradley EH. Patterns of collaboration among health care and social services providers in communities with lower health care utilization and costs. *Health Serv Res* 2018;53 Suppl 1: 2892–2909.
16. Raifman J, Nocka K, Jones D, et al. COVID-19 US state policy database. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 2021. Doi: <https://doi.org/10.3886/E119446V113>
17. Dong E, Du H, Gardner L. An interactive web-based dashboard to track COVID-19 in real time. *Lancet Inf Dis* 2020;20:533–534.
18. Park S, Hamadi H, Apatu E, Spaulding AC. Hospital partnerships in population health initiatives. *Popul Health Manag* 2020;23:226–233.
19. Stall NM, Farquharson C, Fan-Lun C, et al. A hospital partnership with a nursing home experiencing a COVID-19 outbreak: description of a multiphase emergency response in Toronto, Canada. *J Am Geriatr Soc* 2020;68: 1376–1381.
20. Bolger J, Kelly M, Whelan C, et al. Public-private partnership: strategies for continuing urgent elective operative care during the COVID-19 pandemic. *Br J Surg* 2020;107: e320–e31.
21. Rajgor DD, Lee MH, Archuleta S, Bagdasarian N, Quek SC. The many estimates of the COVID-19 case fatality rate. *Lancet Infect Dis* 2020;20:776–777.
22. Hick JL, Hanfling D, Burstein JL, et al. Health care facility and community strategies for patient care surge capacity. *Ann Emerg Med* 2004;44:253–261.
23. Roussos ST, Fawcett SB. A review of collaborative partnerships as a strategy for improving community health. *Annu Rev Public Health* 2000;21:369–402.
24. Miller IF, Becker AD, Grenfell BT, Metcalf CJE. Disease and healthcare burden of COVID-19 in the United States. *Nat Med* 2020;26:1212–1217.
25. Taylor NK, Aboelata N, Mahoney M, et al. Building bridges between community health centers and academic medical centers in a COVID-19 pandemic. *J Am Board Fam Med* 2021;34(Suppl):S229–s232.
26. Chin T, Kahn R, Li R, et al. US-county level variation in intersecting individual, household and community characteristics relevant to COVID-19 and planning an equitable response: a cross-sectional analysis. *BMJ Open* 2020;10: e039886.
27. McClung N, Chamberland M, Kinlaw K, et al. The advisory committee on immunization practices' ethical principles for allocating initial supplies of COVID-19 vaccine—United States, 2020. *Morb Mortal Wkly Rep* 2020;69:1782.
28. Zimmerman FJ, Anderson NW. Trends in health equity in the United States by race/ethnicity, sex, and income, 1993–2017. *JAMA Netw Open* 2019;2:e196386–e196386.
29. Haley DR, Zhao M, Spaulding A. Hospital value-based purchasing and 30-day readmissions: Are hospitals ready. *Nurs Econ* 2016;34:110–116.
30. Zhao M, Haley DR, Spaulding A, Balogh HA. Value-based purchasing, efficiency, and hospital performance. *Health Care Manag* 2015;34:4–13.
31. Berenson R, Burton R. Next steps for ACOs. *Health Affairs/RWJF Health Policy Brief Series*. 2012.
32. Casalino LP, Erb N, Joshi MS, Shortell SM. Accountable care organizations and population health organizations. *J Health Polit Policy Law* 2015;40:821–837.
33. Morrissey J. New models of community care. *Health Progress (Saint Louis, Mo)*. 2015;96:19–23.
34. Kelly MD, Starr T. Shaping service-academia partnerships to facilitate safe and quality transitions in care. *Nurs Econ* 2013;31:6.

Address correspondence to:
 Sinyoung Park, PhD
 Department of Health Administration
 Brooks College of Health
 University of North Florida
 1 UNF Drive, Building 39, Room 4053
 Jacksonville, FL 32256
 USA

E-mail: sinyoung.park@unf.edu